

Claims

1. An actuator including an electromagnetic coil arrangement being movable relative to a magnetic field generator, between first and second positions of the actuator, the actuator being arranged such that, with the actuator in the first position, a pulse of current through the electromagnetic coil arrangement produces a region of magnetic field that repels the magnetic field generator from the first position of the actuator and attracts the magnetic field generator towards the second position of the actuator to move the actuator to its second position.
2. An actuator as defined in claim 1, in which the magnetic field generator is a permanent magnet.
3. An actuator as defined in claim 1, in which the magnetic field generator is a further electromagnetic coil.
4. An actuator as defined in any preceding claim in which actuation causes movement of the magnetic field generator.
5. An actuator as defined in any one of claims 1 to 3 in which actuation causes movement of the electromagnetic coil.
6. An actuator as defined in any preceding claim in which the relative movement is pivotal movement.
7. An actuator as defined in any one of claims 1 to 5 in which the relative movement is linear movement.
8. An actuator as defined in any preceding claim in which the electromagnetic coil includes a magnetic core.

9. An actuator as defined in any preceding claim in which the electromagnetic coil includes a frame.
10. An actuator as defined in claim 9 when dependent upon claim 8 wherein the
5 frame is connected to one end of the core.
11. An actuator as defined in claim 9 or 10 wherein the frame is positioned on one side of the electromagnetic coil.
- 10 12. An actuator as defined in any one of claims 8 to 11 wherein an end of the frame is spaced from an end of the core to provide said region of magnetic field.
13. An actuator as defined in any preceding claim wherein said region of magnetic field is at an end of the electromagnetic coil.
- 15 14. An actuator as defined in claim 13 wherein said region of magnetic field is between the central region of the electromagnetic core and an outer region of the electromagnetic coil.
- 20 15. An actuator as defined in claim 14 wherein said region of electromagnetic flux is positioned over a limited circumferential extent of the coil.
16. An actuator as defined in any preceding claim wherein an air gap is provided between the electromagnetic coil and the magnetic field generator when the actuator is
25 in the first position.
17. An actuator as defined in any preceding claim wherein an air gap is provided between the electromagnetic coil and the magnetic field generator when the actuator is
30 in the second position.
18. An actuator as defined in claim 16 or 17 wherein the air gap is 0.5 mm or more, and preferably 1 mm or more.

19. An actuator as defined in claim 16, 17 or 18, wherein the air gap is 5 mm or less, and preferably 4 mm or less.
- 5 20. An actuator as defined in any preceding claim operable at 14 volts or less, preferably 12 volts or less, more preferably 8 volts or less.
21. An actuator as defined in any one of claims 1 to 19 operable at 28 volts or less, preferably 24 volts or less, more preferably 16 volts or less.
- 10 22. An actuator as defined in any one of claims 1 to 19 operable at 49 volts or less, preferably 42 volts or less, more preferably 28 volts or less.
- 15 23. An actuator as defined in any one of claims 1 to 8, wherein the magnetic field generator is in the form of a first and second magnetic field generator in spaced apart relationship between which is situated the electromagnetic coil.
- 20 24. An actuator as defined in claim 23 when dependent upon claim 4 wherein the first and second magnetic field generators are mounted on a non-magnetic frame, such that the first and second magnetic field generators and the frame move during actuation of the actuator.
- 25 25. An actuator as defined in any preceding claim wherein the electromagnetic coil includes magnetic material to maintain the relative position of the electromagnetic coil and magnetic field generator in the first and/or second positions of the actuator by attraction of the magnetic field generator, in the absence of current through the electromagnetic coil.
- 30 26. An actuator as defined in any preceding claim used to provide security functions on a vehicle.

27. An actuator as defined in claim 26 used to provide a lock/unlock function by blocking/unblocking a transmission path between a handle and a latch.
28. An actuator as defined in claim 26 used to provide free-wheel locking function
5 in a transmission path between a handle and a latch.
29. An actuator as defined in claim 26 used to provide a superlock function.
30. An actuator as defined in claim 26 used to provide a child safety function.
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31. An actuator as defined in claim 26 used to release a latch.
32. An actuator as defined in claim 26 used to latch a latch.
- 15 33. An actuator as defined in any one of claims 27 to 32 positioned in a latch housing of a latch.
34. An actuator as defined in claim 26 used to open or unlatch a fuel-filler flap.
- 20 35. A valve including an actuator as defined in any one of claims 1 to 25, wherein the electromagnetic coil or magnetic field generator is able to open and close a valve port.
- 25 36. A valve as defined in claim 35 wherein the electromagnetic coil or magnetic field generator blocks a first valve port and opens a second valve port when the actuator is in the first position, and the electromagnetic coil or magnetic field generator blocks the second valve port and opens the first valve port when in the second position of the actuator.
- 30 37. A valve as defined in claim 35 or 36, wherein the electromagnetic coil or magnetic field generator is situated on an upstream side of the or each blocked port.

38. A relay including an actuator as defined in any of claims 1 to 25, wherein the electromagnetic coil or magnetic field generator move to connect and disconnect the relay contacts.